NRC·CNRC
Institute for Research in Construction

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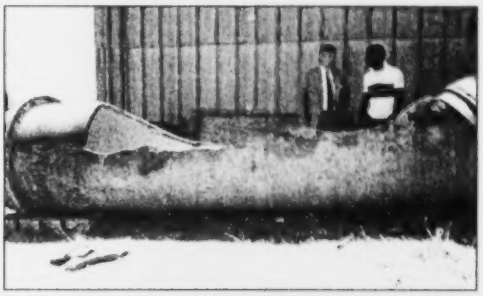
construction innovation

Prototype software helps predict failure in large-diameter water mains

Occurrences of failure in large-diameter water mains are few and far between, but when these buried pipes do fail, they fail in a big way. The consequences can be catastrophic, including prolonged service disruptions, flooding, major traffic and business disruptions, and contaminated water supplies. The cost of repair is also enormous.



A failed large-diameter water main

Because these events are likely to increase as buried pipes get older, researchers in NRC-IRC's Urban Infrastructure program have developed prototype computer software to help municipalities predict deterioration, evaluate the risk of failure and make decisions about repair and renewal in aging water mains. Fifty per cent of the funding for this work came from the American Water Works Association Research Foundation (AwwaRF), through which the software and the research report are now available. NRC funded the rest and nine water utilities from the U.S., Australia and Canada also provided in-kind support for this research.

One of the biggest obstacles to effectively modelling these large pipes has always been the lack of historical data about failure events. To overcome this difficulty, the software uses fuzzy logic modelling as its basis, which is well suited to the interpretation of data that involve a certain amount of subjective judgment and expert opinion, as well as scarce field data.

To use the software effectively, municipalities must perform at least one thorough inspection of the pipe, documenting all observed distress indicators. These distress indicators are interpreted into a condition rating, which is subsequently used to calibrate the deterioration model. Once the deterioration rate is established, a reasonable prediction can be made about the future condition of the pipe and about its risk of failure, determined by both the likelihood of failure and its consequences.

Municipalities then set their own level of maximum risk tolerance (MRT), compare it with the failure risk that is predicted for the pipe in the future, and obtain an idea of when this MRT is expected to be exceeded. With this information, they can make informed and rational decisions about whether or not to rehabilitate the pipe or when to schedule the next inspection.

At a workshop in December 2004, participants found the software useful for the purposes of risk management and communication with policy makers. It was recognized as a good start in helping practitioners begin a structured and rational approach to decision-making on large-diameter water mains. Based on this feedback, the researchers expect the software to provide a useful tool for municipalities throughout North America and around the world.

To obtain this report go to http://www.awwa.org/bookstore/product.cfm?id=91087.

Specific questions about the project can be directed to Dr. Yehuda Kleiner at (613) 993-3805, fax (613) 954-5984, or e-mail yehuda.kleiner@nrc-cnrc.gc.ca.

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Read *Construction Innovation* on the Web at **http://irc.nrc-cnrc.gc.ca/ci**

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2007-03621/

Seminars on 2005 National Construction Codes technical changes

NRC-IRC is holding seminars, in coordination with the provinces and territories, on the most significant technical changes in the 2005 National Construction Codes, with a brief introduction to the new objective-based format. The seminars will be held in sixteen cities across Canada from December 5, 2005 to April 11, 2006. (See back page of this issue for schedule.)

The content of the seminars will be covered over two consecutive days in each city and will be delivered by technical advisors from NRC-IRC's Canadian Codes Centre. Participants will have the option of registering for the full two days, for one day, or even for half-day sessions, according to which topics are of interest to them.

Program

Here are some of the technical changes you will learn about in each half-day session:

NBC Part 9: Housing and Small Buildings (half-day session)

- Clarification regarding the application of Part 4 versus Part 9 structural requirements
- Simplified snow load calculation
- Changes to requirements for foundations and lateral bracing for decks
- New prescriptive requirements for insulated concrete form walls for small houses
- New requirements for flashing and capillary breaks to better protect buildings from rain water ingress
- Up-dated ventilation requirements

NBC Part 3: Fire Protection, Occupant Safety and Accessibility (half-day session)

- Relaxation of requirements for the use of materials of limited combustibility
- Changes to a more performance-based requirement for firewalls
- Several changes regarding mezzanines
- Revised requirements for non-metallic raceways
- Revised requirements for signal circuits serving fire alarm audible devices
- Relaxation in certain requirements for sprinkler systems in dwelling units

NFC (half-day session)

- Control of the accumulation of cables in plenums
- Segregation of oxidizers and flammable and combustible liquids in large mercantile occupancies
- New Section on leakage detection of storage tanks and piping systems for flammable and combustible liquids
- Reference to new NFPA standards for hazardous processes and operations
- Reference to new NFPA standards for the inspection and maintenance of water-based fire protection systems

NPC and NBC Parts 4, 5, 6 (half-day session)

NPC

- Harmonized venting requirements
- Harmonization of NPC and CSA B64.10, "Standard for Backflow Prevention Devices"
- Recognition of new products such as air admittance valves and macerating toilets
- Rehabilitation of drainage systems using trenchless technology
- Water hammer arresters
- Drain requirements for elevator pits
- Drain pan required for hot water heaters

NBC Part 4: Structural Design

- Live loads
- Companion action format
- Earthquake design
- New table of "Importance Categories" based on their use and occupancy, and associated importance factors assigned for snow, wind and earthquake loads
- Changes to snow and wind loads
- Working Stress Design removed from NBC Part 4

NBC Part 5: Environmental Separation

- Amendments for more performance-based basic heat transfer, air leakage and vapour diffusion requirements
- New requirements for resistance or accommodation of structural loads
- Expanded list of referenced standards

NBC Part 6: Heating, Ventilating and Air-Conditioning

- Requirement for carbon monoxide alarms
- Garage ventilation revisions to recognize diesel fuel-powered vehicles
- Revisions to clarify the types of spaces in buildings that do not require mechanical ventilation
- Acceptance of natural ventilation in lieu of mechanical ventilation in certain climatic zones

Registration

Go to the Web site at **www.nationalcodes.ca/seminars** for more details on dates and registration. You are encouraged to pre-register by downloading the registration form **and faxing it to (613) 952-7673 or mailing it to the address below.**

Client Services (Monique Myre)
National Research Council Canada/
Institute for Research in Construction
Seminars on Technical Changes in the
2005 National Construction Codes
Building M-20, 1200 Montreal Road
Ottawa, ON K1A 0R6

CCBFC renews its membership and decides on initial code development priorities

The Canadian Commission on Building and Fire Codes (CCBFC), which is appointed by NRC to provide governance to the development of the National Construction Codes, has recently renewed its membership in preparation for the new code development cycle. The National Construction Codes comprise the National Building Code, the National Fire Code and the National Plumbing Code.

While the Commission will benefit from the fresh perspective of the new members, it will also be able to rely on the experience of a few veteran members, including the chairman, Bruce Clemmensen, who has been reappointed as chair.

Mr. Clemmensen guided the Commission at a time when codes underwent a major change—the recently published 2005 National Construction Codes (see *Construction Innovation*, September 2005) have been re-cast in an "objective-based" format and provide greatly expanded information that makes them easier to use when proposing or evaluating "alternative solutions." In addition to his duties as chair of the CCBFC, Mr. Clemmensen is president of Clemmensen and Associates Limited, of Toronto, a design and construction-management firm; he is a former president of the Canadian Home Builders' Association.

The CCBFC's membership provides broad representation from industry, the regulatory community and the general public from across Canada. Members of the CCBFC and its subcommittees are volunteers chosen for their expertise rather than as representatives of any specific organization. Terms are normally three to five years; however, members, including chairs, may be reappointed for additional terms.

Code development priorities

As its first task, at its meeting in June 2005, the renewed membership of the CCBFC adopted the initial priorities for the technical development of the codes during the next cycle. The decisions on priorities were made in consultation with the

Continued on page 4

CD-ROM versions of 2005 National Construction Codes available soon

The CD-ROM versions of the 2005 National Building, Fire and Plumbing Codes will be released in **spring 2006**. These versions will facilitate the use of the new "objective-based" format because they will enable users to navigate easily between the various Parts of the Codes. The integrated links will allow for instant cross-referencing to other Code provisions, definitions and appendix notes. The CD-ROM versions will also include an easy to use search engine and will be offered as both single-user and multi-user licenses.

One of the main features of the CD-ROM versions of the Codes is the linking of most Code provisions to:

- intent statements (detailed statements on the specific intent of the provisions), and
- application statements (detailed statements on what the provisions apply to).

The intent and application statements are available only in electronic format. They are strictly for explanatory purposes and do not form an integral part of the Codes' provisions. Because of the sheer volume of intent and applications statements—thousands for the National Building Code alone—they will not be published in a printed version.

The intent and application statements are also available separately in CD-ROMs entitled "User's Guides," which complement the printed versions of the Codes. The following User's Guides will be released as CD-ROMs in **spring 2006**:

- User's Guide – NBC 2005, Application and Intent Statements
- User's Guide – NFC 2005, Application and Intent Statements
- User's Guide – NPC 2005, Application and Intent Statements

These User's Guides and the CD-ROM versions of the 2005 National Building, Fire and Plumbing Codes will only be available for PCs using Microsoft Windows.

The printed versions of the 2005 National Building, Fire and Plumbing Codes are now available for purchase through the National Research Council's Virtual Store at www.nrc.gc.ca/virtualstore.

For more information on the 2005 National Construction Codes, please visit the National Codes Web site at www.nationalcodes.ca.

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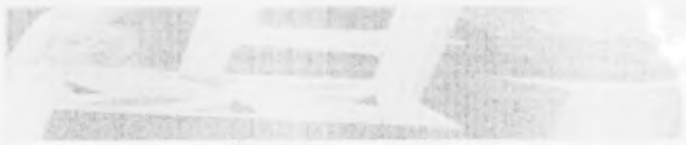


CCMC

Canadian Commission on Construction Materials Evaluation (CCCME) appoints new chair

Dr. Don Figley, who has had an extensive career in the construction industry as a researcher, consultant and practitioner, has been appointed as chair of the CCCME for the next three years, effective November 2005.

The CCCME provides guidance on policy and operational direction for the Canadian Construction Materials Centre (CCMC) and the Canadian Infrastructure Technical Assessment Centre (CITAC), with its membership representing a cross-section of stakeholders from the construction and infrastructure sectors throughout Canada.

"With the introduction of the 2005 objective-based code in September 2005, a major challenge for CCMC will be to adapt its services and processes to respond to the expected increase in the use of alternative solutions..."

"This is an exciting time in the life of CCMC as it makes the transition to objective-based codes as the basis of its evaluations of innovative construction products," says Dr. Figley.

He went on to say, "The new Code format allows the construction industry to better utilize modern building technologies. With the introduction of the 2005 objective-based code in September 2005, a major challenge for CCMC will be to adapt its services and processes to respond to the expected increase in the use of alternative solutions. CCCME will provide advice and guidance to CCMC in its efforts to redefine its services and monitor the impact of these changes."

CCMC will also focus on increased technical input to its evaluations via the Commission's Standing Committee on Technical Evaluations, and will review and publish updated business policies to reflect these changes.

And with the current focus on Canada's aging infrastructure, CITAC is expected to play an important role in providing independent technical opinions on new and innovative products that could be beneficial to manufacturers, engineers, municipalities and the provinces by reducing costs and the need for repeat testing.

CCBFC renews its membership and decides on initial code development priorities

Continued from page 3

Provincial Territorial Policy Advisory Committee on Codes (PTPACC). These priorities were selected from recommendations of a report developed by a joint CCBFC/PTPACC task group assigned to identify priority changes to the codes (see *Construction Innovation*, March 2005). Thirty-seven initial priority technical issues were identified, with the possibility of more being added as the cycle progresses. The joint CCBFC/PTPACC task group report and these priorities are currently posted on the national codes Web site at www.nationalcodes.ca/ccbfc/twojointtg_e.shtml.

New standing committees are being formed to undertake the work on the initial priorities adopted by the CCFBC. If other issues are identified that are not on this list of priorities, they will be considered by the CCBFC at a later date. The work of the standing committees will be covered in a future issue of *Construction Innovation*.

For more information on the initial priorities for the development of the National Construction Codes, please contact John Archer, Secretary to the CCBFC, at (613) 993-9960, fax (613) 952-4040, or e-mail codes@nrc-cnrc.gc.ca.

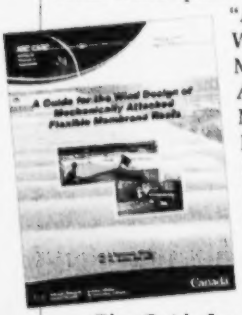
New CCMC Evaluation Reports

Company	Product Name	CCMC #	Description
Ark-Seal Inc. International	BLOW-IN-BLANKET® System (BIBS®) Dry	13198-R	A dry blown mineral fibre insulation that is injected into wall cavities through a nylon mesh stapled to the studs.
Millennium Decking Inc.	Millennium Decking	13200-R	A cellulosic/polymer composite made primarily of recycled polyvinyl-chloride (PVC) and wood flour. The product is used as exterior decking installed over traditional wood framing.
Louisiana-Pacific Corporation	LP OSB Rim Board	13204-R	An enhanced oriented strandboard (OSB) acting as a rim board in conjunction with engineered wood floor systems.

For further information on the performance, usage and limitations of these products, as well as other reports and listings by CCMC, see the Web Registry of Product Evaluations located at **http://irc.nrc-cnrc.gc.ca/ccmc/regprodeval_e.shtml**.

NRC-IRC publishes new guide for the wind design of mechanically attached roofs

A new publication from the Institute for Research in Construction provides engineers, architects and building officials with information on how to better design mechanically attached flexible membrane roof assemblies to resist wind uplift. This publication, "A Guide for the Wind Design of Mechanically Attached Flexible Membrane Roofs," will help improve roof performance and reduce losses as a result of roof failure in high winds.



The *Guide* for new construction was developed by a North American consortium known as the Special Interest Group for Dynamic Evaluation of Roofing Systems (SIGDERS, see sidebar below) and is based on:

- wind research conducted by the consortium
- input and comments from members, and
- data and information collected from a literature review.

Wind is one of the essential considerations in roof design. Poor design or faulty construction, or the selection of non-compatible materials, can result in severe wind damage to the roof, the cost of which is often exceeded by losses associated with interior damage and interruption of occupancy. (See related article in *Construction Innovation*, March 2005.)

This 107-page *Guide*, which will help advance the design and construction of durable roofing systems, captures ten years of research at NRC-IRC on flexible membrane roofs (used on more than 54% of North American commercial buildings). Superbly illustrated with over 60 colour figures and photographs, this comprehensive publication presents the following information:

- characteristics of mechanically attached roof systems
- an outline of the wind design process
- a review of a new dynamic wind uplift testing protocol and a comparison to other protocols now in use
- detailed example wind load calculations for Canada and the United States, based on the National Building Code of Canada 2005 and the American Society of Civil Engineers procedure ASCE 7-02, respectively
- an overview of design procedures for wind uplift resistance in the two countries
- material characteristics and component selection for decks, air and vapour retarders (barriers), insulation and membranes.

For technical information, please contact Dr. Bas Baskaran at (613) 990-3616, fax (613) 998-6802, or e-mail bas.baskaran@nrc-cnrc.gc.ca.

SIGDERS

Ten years ago members of the roofing community met at the National Research Council of Canada and formed SIGDERS, a group to evaluate roofing systems under dynamic conditions. The group's mandate is to carry out generic, pre-competitive research of benefit to all its members (see previous article in *Construction Innovation*, September 2002).

Recently, a dynamic wind uplift test standard, CSA A123.21-04 – Standard Test Method for the Dynamic Wind Uplift Resistance of Mechanically Attached Roofing Systems, which was the culmination of this collaboration, has been published by the Canadian Standards Association. Copies can be obtained from www.shopcsa.ca.

Newsbrief

SIGDERS project, Phase IV

The current phase of the SIGDERS project, Phase IV, is addressing the following issues regarding mechanically attached roofs:

- identify how the properties of steel decks affect their wind-uplift resistance, and quantify those effects
- develop and apply a test procedure to quantify the air-leakage rate through these roofs
- determine how wind-uplift resistance, and the field, edge, and corner zones of the roof, correlate with each other in real applications.

The expected project outcomes include a test procedure for measuring air leakage through these roofs and design tables showing the relationship between their uplift resistance and the properties of steel decks.

Partners

Associations:
Canadian Roofing Contractors' Association, Canadian Sheet Steel Building Institute, National Roofing Contractors Association, Roof Consultants Institute

Manufacturers:
Atlas Roofing Corp., Canadian General Tower Ltd., Carlisle SynTec Inc., GAF Materials Corp., GenFlex Roofing Systems, Firestone Building Products, IKO Industries Limited, ITW Buildex, Johns Manville Corp., Sarnafil Ltd., Stevens Roofing, Soprema Canada, Tremco Inc., Trufast Corp.

Building Owners:
Canada Post Corporation, Public Works and Government Services Canada.

If you are interested in joining this project or have questions about it, please contact Dr. Bas Baskaran at (613) 990-3616, fax (613) 998-6802, or e-mail bas.baskaran@nrc-cnrc.gc.ca.

The cost of the *Guide* is $50 plus applicable taxes. Copies can be ordered online from NRC's Virtual store at www.nrc.gc.ca/virtualstore. Click on NRC Construction Publications, then go to Hot Picks and click on Wind Design Guide. Or contact IRC Client Services at 1-800-672-7990 or (613) 993-2463, fax (613) 952-7673, or e-mail IRCpubsales@nrc-cnrc.gc.ca.

In-depth analysis of World Trade Center disaster provides recommendations to improve fire safety in high-rise buildings

It is now four years since the terrorist attacks on the World Trade Centre (WTC). And while the investigations of buildings subjected to extreme conditions, such as fires, hurricanes and earthquakes, can take considerable time and resources to complete, they can provide essential information on the performance of building systems under such conditions, and result in recommendations to improve their design.

The National Institute of Standards and Technology (NIST) has just concluded a multi-million dollar investigation on the World Trade Center, which provides extensive recommendations on how to improve fire safety in high-rise buildings. The final report was released in October 2005. (The report and associated documents can be downloaded from the NIST Web site at wtc.nist.gov.)

In the course of this project, over 1,000 survivors were interviewed. There were 803 telephone interviews, 225 face-to-face interviews and five focus groups.

NRC-IRC's Dr. Guylène Proulx, an expert in human behaviour in fire, was an advisor on the NIST project team that looked at occupant behavior, egress, and emergency communication. She was responsible for advising the research team on the development of the study methodology and was involved in the review of the findings.

In the course of this project, over 1,000 survivors were interviewed. There were 803 telephone interviews, 225 face-to-face interviews and five focus groups. This approach was taken to capture the full range of conditions experienced by the occupants. Survivor accounts found in the media were also analyzed, as were 911 calls and transcripts of emergency communication. As well, documentation on the emergency procedure followed and the training provided were considered; and historical building design drawings were studied and compared to the requirements of both contemporary and current American codes.

NIST's report on its World Trade Center investigation provides recommendations for improving fire safety in high-rise buildings.

The main findings from the project related to occupants' behaviour were as follows:

- About 8,700 people were in each of the two towers on the morning of September 11, 2001. Approximately 87% of these occupants and over 99% of those located below the floors of impact were able to successfully evacuate.
- Computer egress modelling showed that if the towers had been at their full capacity of 25,000 occupants per tower, evacuation would have taken about four hours, and that if they had been fully occupied, over 14,000 people might have perished in the collapse of the buildings.
- It is estimated that the use of elevators for 16 minutes in the second tower (WTC 2) before it was hit saved roughly 3,000 lives.
- The number and width of exits and stairwells was adequate to accommodate the low density of occupants in the towers at the time of the attacks. Contrary to some perceptions, the fact that firefighters were ascending the stairs while occupants were descending did not significantly increase the overall evacuation time.
- It is assumed that most of the 111 building occupants killed below the floors of impact were incapable of using the stairs because of injuries or disabilities.

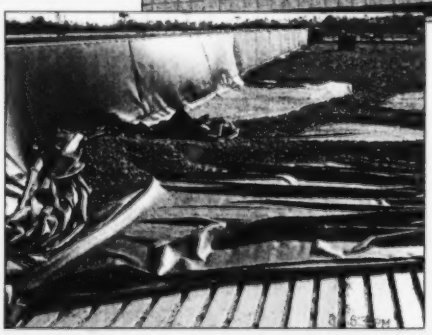
The investigation report concludes with a list of 30 recommendations that require action in the areas of increased structural integrity; enhanced structural fire resistance; new methods for the design of structures that can resist fire; enhanced active fire protection; improved building evacuation procedures, emergency response, and procedures and practices that encourage code compliance and the adoption and application of egress requirements; and continuing education and training for fire-protection engineers, structural engineers and architects.

Specific questions about this project can be directed to Dr. Guylène Proulx at (613) 993-9634, fax (613) 954-0483, or e-mail guylene.proulx@nrc-cnrc.gc.ca.

NRC-IRC researcher part of investigations following Hurricane Katrina

NRC-IRC's expertise was also called upon recently in the wake of Hurricane Katrina. Dr. Bas Baskaran was asked, as part of the RICOWI team (see *Construction Innovation*, March 2005), to visit various sites stricken by the hurricane to investigate the damage to roofs.

As part of the RICOWI (Roofing Industry Committee on Weather Issues) investigation, six teams were deployed to the Katrina-stricken area on September 6, with headquarters in Mobile, Alabama.



Ballasted roof is completely blown off by wind (top and middle).

The teams conducted investigations on several types of roofing systems. Their work included inspections of essential facilities, schools, hotels and residential structures between Bay St. Louis (East of New Orleans) and Pascagoula, Mississippi, with some as far up the coast as Hattiesburg, Mississippi.

The information obtained from these investigations, coupled with ongoing roofing research at NRC-IRC, will be invaluable in developing codes and standards that will result in more wind resistant roofs.

The teams did not go into the New Orleans storm surge area, as the focus of their investigation was related to the structural damage and failure of roofs as a consequence of hurricane-force winds, which were most severe in the locations investigated.

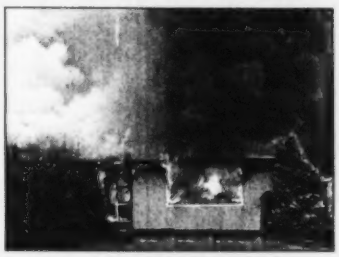
The information obtained from these investigations, coupled with ongoing roofing research at NRC-IRC, will be invaluable in developing codes and standards that will result in more wind resistant roofs.

Preliminary failure data from the investigation will be presented at the RICOWI spring meeting to be held in May 2006. More detailed information from the investigations following Hurricane Katrina will appear in a subsequent issue of *Construction Innovation*.

Specific questions can be directed to Dr. Bas Baskaran at (613) 990-3616, fax (613) 998-6802, or e-mail bas.baskaran@nrc-cnrc.gc.ca.

Newsbrief

New project to characterize fires in multi-suite residential buildings will include secondary suites and care facilities



Researchers draw on information obtained from real fires, such as this one in Kemano, BC, to develop realistic simulated fires to use in their studies of fire-safety issues.

A research project to study the effects of fires in multi-suite residential occupancies, originally proposed in 2003 (see *Construction Innovation*, December 2003), raised concerns among stakeholders about the potential of fires to have unique consequences in secondary suites and residential care facilities. As a result, the scope of the project has been expanded to include these types of facilities.

A secondary suite is defined as a second dwelling unit located within the structure of an owner-occupied single-family dwelling. Residential care facilities are defined as having four or more beds and are funded and regulated by provincial or territorial departments of health and/or social services; they include homes for the aged and for persons with various types of disabilities.

As engineering-based methods of analysis are increasingly used to solve fire-safety problems, it is vital that these methods use realistic simulated fires (i.e., design fires) for the results to be credible. This expanded research project will make use of computer simulations and full-scale fire experiments in realistically furnished rooms. Its primary objective is to determine the characteristics of residential fires and typical fire loads, and to express this information in the form of design fires that can be utilized for evaluating the potential impact of fires on life safety, and on the performance of building elements and fire-safety systems.

NRC-IRC is seeking participation from provincial and territorial regulatory authorities, and other organizations with an interest in research related to secondary suites and residential care facilities. To participate in the project or to obtain further information, please contact Dr. Alex Bwalya at (613) 993-9739, fax (613) 954-0483, or e-mail alex.bwalya@nrc-cnrc.gc.ca.

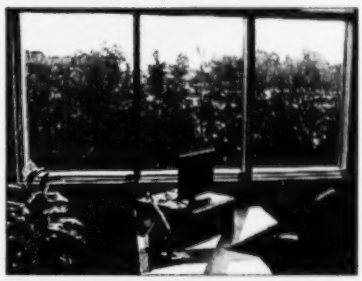
New model calculates lighting and view indices for complex fenestration systems

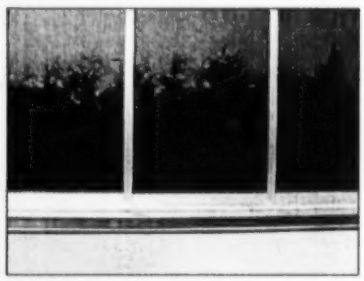
Although energy conservation is certainly not a new imperative, rising fuel costs have made it much more of a priority for many Canadians. One option for energy savings that is bound to increase in popularity is the installation of complex fenestration systems in buildings.

For several years, the need for energy conservation has spurred innovations in window design, including shading devices, complex glazings, translucent and transparent insulation and patterned glass. Unfortunately, little is known about their impact on the quality of the indoor environment. As a first step to filling in this gap in knowledge, researchers in NRC-IRC's Indoor Environment program have developed new indices to measure the performance aspects of complex fenestration systems that could affect indoor lighting and view.

To gather the necessary information, the researchers developed detailed calculation models to determine how complex fenestration systems made up of a mixture of clear and scattering glazing layers affect lighting and view. These characteristics include the amount of light passing through the window (transmittance), the amount of light reflected by the window (reflectance), the amount of light absorbed by the window glazing layers (absorptance), the scattered amount of incident light after transmission and reflection (haze), and the intensity of the light in the window (luminance).

The values obtained from these calculations allowed the researchers to determine, for example, whether glazings allow people outside a view into the building (which may affect feelings of privacy), give occupants a view of the outdoors, and reduce or eliminate potential glare problems. With these insights, the researchers were then able to develop indices of physical performance for lighting and view that are expected to relate to occupant satisfaction. These indices are also expected to be validated through human factors studies and integrated into fenestration standards.





View out (left) and view in (right)
The outdoor and indoor views through a double clear window on a clear sunny day. Outdoor objects can be clearly seen from inside whereas indoor objects cannot be seen from outside due to reflectance.

View of outdoors through a double clear window with an interior black perforated screen under a partly cloudy sky

To demonstrate the effectiveness of the models, the researchers applied them to some typical fenestration systems. These included a double window with a clear pane over a pane that diffuses the light, a double clear window with a fritted exterior pane (glass with granules fused onto it to create a frost-like pattern), and a double window with two clear panes equipped with an exterior perforated shading screen and an interior drapery. Results indicate that:

- By design, the clear-over-diffuse window provides no view indoors or outdoors (as expected). When compared with a clear window with the same transmittance, however, the diffuse window reduces the luminance of the window by up to 28 per cent under overcast sky conditions, but increases it by more than 100 per cent under clear sky conditions.
- The white opaque frits (patterns) on the fritted window slightly affect the outdoor view, but fully impair the view to the indoors under clear sky conditions and typical office interior lighting. In addition, they reduce the window's luminance.
- A dark-coloured exterior screen slightly affects the outdoor view and reduces the window's luminance independently of the sky condition. A light-coloured screen, however, has a significant impact on the outdoor view and the window's luminance, depending on the sky conditions: under clear sky conditions, the window's luminance is increased by about 33 per cent compared

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Institut de recherche en construction

CONSTRUCTION CODES ORDER FORM

	DOCUMENT	PRINTED COPY: Binder	Specify Quantity	PRINTED COPY: Soft Cover	Specify Quantity	CD-ROM FORMAT*: # of Users (concurrent) ⇨ / Specify Quantity ⇨ / Select (√) Document(s) ⇩	STAND ALONE: 1 user	NETWORK PACKS: 1-2 users	3-5 users	6-10 users
☆ NEW ☆	**2005 DOCUMENTS**									
☆ NEW ☆	National Building Code 2005	$200		$190						
☆ NEW ☆	National Fire Code 2005	$140		$130						
☆ NEW ☆	National Plumbing Code 2005	$120		$110						
	1995 DOCUMENTS									
	National Building Code 1995	$99		$94			$179	$358	$715	$1,073
	Practical 1995 NBC User's Guides:									
	Fire Protection, Occupant Safety, Accessibility (Part 3)	n/a		$47			$71	$142	$284	$426
	Structural Commentaries (Part 4)	n/a		$47			$71	$142	$284	$426
	Environmental Separation (Part 5)	n/a		$47			$85	$170	$341	$511
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	Application of Part 9 to Existing Buildings	n/a		$47			$85	$170	$341	$511
	Quebec Construction Code – Chapter 1, Building, and National Building Code 1995 (amended)	$120		$110			$179	$358	$715	$1,073
	National Housing Code 1998 and Illustrated Guide	n/a		$94			$179	$358	$715	$1,073
	National Fire Code 1995	$69		$64			$125	$250	$500	$749
	National Plumbing Code 1995	$59		$54			$89	$178	$356	$534
	User's Guide on the 1995 National Plumbing Code	n/a		$47			$85	$170	$341	$511
	National Farm Building Code 1995	n/a		$34			$51	$102	$204	$306
	Model National Energy Code 1997 – Buildings	$79		n/a			$119	$238	$476	$714
	Model National Energy Code 1997 – Houses	$69		n/a			$104	$208	$416	$624
	Alberta Building Code 1997 on CD***	n/a		n/a			$149	$298	$596	$894
	Alberta Fire Code 1997 on CD****	n/a		n/a			$104	$208	$416	$624
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*CD-ROM version of 2005 Codes available in early 2006
** n/a = not applicable
*** Includes access to NBC 1995
**** Includes access to NFC 1995

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For more information, please call 1 (800) 672-7990 or 1 (613) 993-2463 (Ottawa-Gatineau and U.S.)

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Revised: December 2005

CI

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What we're hearing

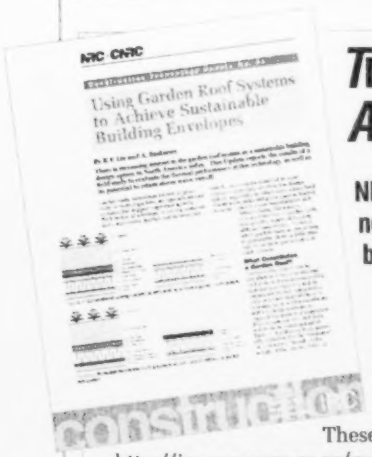
EU poised to begin energy labelling program for buildings

As January 4, 2006, approaches, the eyes of the construction world are on Europe to see how the member countries in the European Union (EU) will adjust to the Directive on the Energy Performance of Buildings. Motivated by the need to safeguard their energy supply, as well as to meet targets outlined in the Kyoto Protocol, the EU has mandated that all new and existing buildings in member countries must have energy performance certificates when they are sold or rented after this date. In addition, all public buildings over 1,000 m^2 must display an energy label in a prominent position for members of the public to see.

Energy labelling to reduce energy consumption is not a new approach to improving energy performance—many countries in North America and Europe have had labelling programs for major appliances for many years. For entire buildings, however, the approach is certainly unique and the savings could be great. The building sector accounts for an estimated 40 per cent of the EU's total energy consumption, and estimates suggest that one fifth of this consumption could be eliminated by 2010 if buildings become more energy efficient.

Each EU country must have a methodology to determine energy performance in place by the deadline, which can take into account country-specific factors such as climate. In addition, the countries must establish minimum performance requirements for new buildings, as well as work on the training and certification of assessors to issue the energy performance certificates. Each country must also enact regular inspection schemes for the energy performance of the boiler and air-conditioning systems to ensure continued energy-efficient operation and to recommend replacement when necessary. Countries can take up to three years to complete these last three tasks if there is a lack of qualified assessors, which there appears to be in most countries.

Regardless of how smoothly the initial implementation of the energy performance standards in buildings directive goes, positive changes should result from it. Member countries will find and train qualified people to carry out the directive. EU citizens will have an increased awareness of the need for energy efficiency, and innovations in energy efficiency, driven by the new need, are bound to appear. For more information, please contact Dr. Morad Atif at (613) 993-9629, fax (613) 954-3733, e-mail morad.atif @nrc-cnrc.gc.ca; or go to http://www.epbd-ca.org/.



Two New Updates Available

NRC-IRC is pleased to announce that two new Construction Technology Updates have been published:

- ***No. 64. Indoor Air Quality and Thermal Comfort in Open-Plan Offices***
- ***No. 65. Using Garden Roof Systems to Achieve Sustainable Building Envelopes***

These are available free on the NRC-IRC Web site at: http://irc.nrc-cnrc.gc.ca/pubs/ctus/index_e.html

You can order printed versions through the NRC Virtual Store: http://www.nrc-cnrc.gc.ca/virtualstore/

Accessing the NRC-IRC Web site for these new Updates is a good opportunity to browse for many other publications that are available free of charge. Start with our main Publications page at: http://irc.nrc-cnrc.gc.ca/pubs/index_e.html. From here you can also search a database containing all publications since our founding in 1947. More than 2,500 are available in full-text, with new publications added weekly.

New model calculates lighting and view indices for complex fenestration systems

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with overcast sky conditions. Dark and light interior draperies affect the results similarly.

In the future, NRC-IRC plans to extend the results of this project to skylights in a new initiative related to its SkyVision project. This initiative will focus on the development of procedures to rate conventional and tubular skylights for both energy performance and lighting quality. SkyVision (http://irc.nrc-cnrc.gc.ca/ie/lighting/daylight/skyvision_e.html) is a publicly available software program that predicts the hourly and annual performance of various types of skylights.

If you are interested in learning more about this work or in participating as a sponsor or partner, please contact Dr. Aziz Laouadi at (613) 990-6868, fax (613) 954-3733, or e-mail aziz.laouadi@nrc-cnrc.gc.ca.

Upcoming events

2006

January 10 to **April 11, 2006** – ***Technical seminars on the 2005 National Construction Codes.***
The seminars will be held in 16 cities across Canada. For more details on dates and registration, go to **www.nationalcodes.ca/seminars**

Ottawa
December 5 and 6, 2005
Embassy West Hotel

Fredericton
January 10 and 11, 2006
Fredericton Inn

St John's
January 12 and 13, 2006
The Fairmont Newfoundland

Charlottetown
January 16 and 17, 2006
Delta Prince Edward

Halifax
January 18 and 19, 2006
Holiday Inn Select

Yellowknife
February 14 and 15, 2006
The Regency Explorer Hotel

Edmonton
February 16 and 17, 2006
Coast Terrace Inn

Saskatoon
February 20 and 21, 2006
Sheraton Cavalier Hotel

Winnipeg
February 22 and 23, 2006
Winnipeg Convention Centre

Toronto North (Vaughan)
March 8 and 9, 2006
Paramount Conference & Event Venue

Toronto West
March 8 and 9, 2006
Days Hotel and Conference Centre

Whitehorse
March 21 and 22, 2006
Westmark Hotel

Vancouver
March 23 and 24, 2006
Vancouver Convention & Exhibition Centre

Victoria
March 27 and 28, 2006
Ambrosia Catering and Event Centre

Calgary
March 29 and 30, 2006
Sheraton Cavalier Hotel

Quebec (French)
April 4 and 5, 2006
Hotel Plaza Quebec

Montreal (French)
April 6 and 7, 2006
Holiday Inn Montreal-Midtown

Montreal (French)
April 10 and 11, 2006
Holiday Inn Montreal-Midtown

construction innovation

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FEBRUARY

Building Science Insight
Regard sur la science du bâtiment
http://icr.nrc-cnrc.gc.ca/bsi/2005

Seminar series – 2005
Séries de séminaires – 2005

Les toitures : à la hauteur de la technologie et changement

(Remaining seminars in French only)

21
Sainte-Foy – Hotel Plaza Quebec
3031, boulevard Laurier
Sainte-Foy, QC G1V 2M2

23
Montreal – Holiday Inn Montreal-Midtown
420 Sherbrooke Street W.
Montreal, QC H3A 1B4

APRIL

23
Symposium on Heat-Air-Moisture Transport: Measurements on Building Materials. Toronto. http://www.astm.org/MEETINGS/COMMIT/C16symp.html

JUNE

14-16
11th International Conference on Computing in Civil and Building Engineering. Montreal. http://www.icccbexi.ca/

14-15
6th International Conference on Performance-Based Codes and Fire Safety Design Methods. Tokyo. www.sfpe.org

This calendar does not include all events scheduled to take place during this time frame. For a more complete listing, see the Web version of "Upcoming events" at http://irc.nrc-cnrc.gc.ca/events_e.html

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